Educational inclusion and new technologies

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Chapter 6

EDUCATIONAL INCLUSION AND NEW TECHNOLOGIES

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ABSTRACT

The development of new technologies creates affordances with the potential to remove barriers to learning faced by young people. New technologies have therefore been seen as both a panacea for problems in developing inclusive education, and as a way of allowing a diverse range of learners to access and engage with the curriculum in its broadest sense. This chapter critically considers these views by drawing on a range of selected research. This research uses different methodologies and educational contexts to sample different levels of use, and different aspects of new technology. The case studies included here illustrate particular issues in developing and using technology. The cases studies cover: using Tablet PCs in schools, developing educational robotics as an inclusive curriculum activity, developing pedagogic practice with morphing software and interactive software designed for dyslexic learners and Schome Park, an interactive virtual environment.

The chapter considers how technology is used in these cases and the degree to which is has supported, educational inclusion. This offers an insight into innovative educational practice and research and supports an analysis of the factors which influence the impact of potentially inclusive technology.

INTRODUCTION

Inclusive Education.

Inclusive education is a worldwide phenomenon (Mittler, 2004) which has grown out of, and been strengthened by, a commitment to enact the values of basic human rights. It involves the creation of situations which equalise opportunity for all learners. Inclusive education has evolved as a movement which challenges exclusionary policies and practices. It has gained ground worldwide over the past decade and has become a favoured approach to addressing the learning needs of all students in regular schools and classrooms (Mittler, 2004). International initiatives have led to a growing consensus that all children have the right to be educated on equal terms with their contemporaries, regardless of their physical, intellectual, emotional, social, linguistic or any other condition, and that such inclusion makes good educational and social sense (UNESCO, 1999, p9).

A key aspect of developing inclusive educational practices and removing barriers to learning is reflection on current understanding and expectations.

> Inclusive education should create opportunities for all learners to work together. This requires a recognition that learning is enhanced when individuals of different abilities, skills and aspirations can work together in a joint enterprise. (Aspis, 2004, p. 129)

This inclusive approach can be contrasted with a ‘deficit’ approach, which foregrounds an individual’s impairments or differences and may consequently lead to segregated education within special settings, or educational practices which separate learners from their peers. Inclusive education is about participation and equal opportunity for all – in other words, full membership of school and, later, society. In order to achieve this, mainstream educational environments will need to become beneficial for a diverse range of learners, who present a diverse range of needs. This view of inclusive education presents a challenge to existing structures and systems which may themselves have created some of the barriers which impede learners.

Inclusion often requires a transformation of education, and new technologies are frequently presented as a means of achieving such change. Such technologies can have significant impact on the development of inclusive environments. This chapter examines the extent to which new technologies are being used to support the development of inclusive educational practices. It draws upon a range of technologies and research, highlighting the potential strengths and weaknesses of specific technological examples in relation to supporting the education of a diverse range of learners.

The educational effects of technology

Introducing technological innovations to classrooms does not necessarily lead to changes in educational practice or to the removal of barriers to learning. New technologies can produce three types of outcome in relation to educational practice (Twining, 2002):

Efficiency. They can make existing practices more efficient.
Extension. They can extend horizons and educational value.
Transformation. They can transform conceptions of a subject.

The five case studies presented here are used to discuss how these three types of outcome impact on educational inclusion.

Outcome 1: Efficiency

The introduction of word processors to classrooms has helped teachers and pupils to produce work that is of a high presentational quality and which is scaffolded by presentation templates, spellcheckers and grammar checkers. Computer-based class work can be accessed by students through a variety of different input devices. These devices include QWERTY and concept keyboards, voice-activated controls and touch screens. In many situations, these technologies are used to address curriculum access, a significant element of inclusive education. For example, access to information for children with learning disabilities is supported by the inclusion of clear and consistent layouts with simplified text (Rix, 2007) and simplified versions of on-screen information with voice-read options (Pavely, 2002). In these cases, learners are enabled to engage more efficiently with the existing curriculum and classroom practices and the underlying pedagogic practices remain unaltered.

Case Study 1: Software and Symbols

Many children with severe learning difficulties experience significant problems in recognising whole words and in developing an initial sight vocabulary of single words (Sheehy, 2002). However, such children learn to recognize logographic pictorial symbols relatively easily. Consequently, educational practitioners have developed a range of symbol-based approaches which have proved effective in developing children’s language skills (Abbott & Lucey, 2005). Symbols can be used to access computer-based activities or to activate hardware such as simple floor robots or musical instruments. Many programs exist which can automatically translate traditional orthography (letters and words) into such symbols. The technology which perform these translations is commonly used in the United Kingdom to make websites and texts (for example health- or law-related materials) accessible to adults with severe learning difficulties (Abbott & Lucey, 2005)

Although the contribution of such symbols to the development of language skills in children with severe learning difficulties is well established, the use of such symbols when teaching word recognition remains controversial. There is considerable evidence that the simple juxtaposition of symbols with words does not support the transfer to recognizing words alone (Sheehy, 2002). However, the value of one symbol-based approach has been identified by empirical research. The symbol accentuation method was developed by Miller (1971, 2000) for people with severe learning disabilities as an aid to developing literacy. The method was developed to make spoken and printed language more meaningful by integrating them with objects. To achieve this aim, the approach gradually alters the shape of a written word to give it meaning at a pictorial level i.e. the picture transforms by degrees in to the written word.

The symbol accentuation method was introduced to the United Kingdom in 1980. The approach required either extensive preparation of drawings for each child or the purchase of commercially produced animation material. These factors of time and cost possibly explain why the method did not take off in the UK at the time. However, new digital technologies have reduced these barriers. High-quality morphing software is now readily available, as freeware or shareware, via the internet. Digital cameras are now common tools in UK classrooms. Consequently, it is possible to experiment with ways of morphing images into words and to explore the usefulness of this approach. Initial research has yielded promising results and there is evidence to suggest that children who fail to master initial word recognition can be assisted by the use of morphing software combined with other pedagogic techniques (Sheehy, 2005).

The development of new technology has helped to improve the efficiency of teaching in this area and has enabled an excluded group to access word recognition. Learners who had previously experienced repeated failure report that the method is enjoyable and motivating. The method has also enabled new theoretical questions to be posed, and researched, regarding how children with severe learning difficulties learn to recognise words.

The extent to which technology has influenced educational practice in this area is unclear. The combined use of morphing software, digital cameras and computers appears to have made an existing practice, creating repeated drawings, much more efficient in terms of time and ease of execution. However, the underlying pedagogy remains the same and the educational model remains focused on deficit, on special needs which must be addressed, rather than on inclusion for all.

Outcome 2: Extension

New technologies can move teaching beyond efficiency by significantly extending the horizons and educational value of an activity. One example, which illustrates an increasingly common practice, is 'The Spike Net Story' (Ware, 2002 cited in Abbott, 2005). A teddy bear called Spike travels to schools in different countries. A record is kept of his visits through diary entries and photographs. This activity leads to pupils contacting pupils at schools around the world. Their knowledge of the world and other people is expanded through Spike. Children find out about other countries and cultures by interacting with people and materials from these places, and by asking their own questions. The technology allows children to go beyond simply accessing information electronically and promotes learning in more personally meaningful and interesting ways. Children can experience greater involvement in their own learning and can also engage authentically with the world. New technologies can be used to enable a more diverse range of children to engage in this way, but activities of this type are not reliant on these technologies (Twining, 2002), rather, they are characterised by a change in how pupils engage with learning that may involve collaborative or interactive activities.

Case Study 2: Speech Software

Speech feedback software provides a technological solution for children who are struggling to learn to read. It is easily used in the classroom on a standard desktop computer, which may be supplemented with a selection of input devices. Speech feedback can be used to provide a more efficient form of guided reading or to extend previous educational experience by motivating and empowering pupils. It has the potential to transform pupils' experience if it used by a variety of learners as a tool to enhance reflection, a tool which allows them to concentrate on the content they are creating, rather than on the means of producing that content. The technology can be used in a variety of ways and it is the pedagogy, rather than the technology itself, which governs the educational outcomes.

The use of speech feedback has become increasingly well established over the last 15 years as a means of improving children's reading performance. (Reinking and Bridewell-Bowles, 1991). There is some evidence that optional speech feedback – in which the spoken form of a word is available on request – is as effective for helping seven year olds who are learning to read as traditional guided reading with a teacher (Singleton and Simmons, 2001). Programs such as Wordshark, which combine speech feedback with a game format, are enjoyed by and motivate children who have experienced failure in developing literacy (Singleton and Simmons, 2001). This software can help pupils to develop skills and awareness of essential elements of literacy including phonics, onset and rhyme, homophones and spelling rules. These elements are vital to the development of young children's reading (Holliman, Wood and Sheehy, 2006) and to those with specific learning difficulties such as dyslexia (Wood, Sheehy and Terrill, 2005). As in Case Study 1, these programs employ existing pedagogical practices in a new format. Technology is used to provide immediate feedback, enjoyable activities and pupil control. As a teacher noted:

> Wordshark is easier to jump in and out of to support your class programme. Children can clearly see where they are going. It has action games to grab their attention and the voice is on straight away. Wordshark has built-in motivation. (McGee, Day and Sheehy, 2001)

The Talking Computer Project (Miles and Clifford, 1994) also used the ability of word processors to talk. In this approach, which has been adapted extensively, computers read typed input produced by the children. This method appears to be highly successful in producing positive changes in children's reading and spelling abilities. Children can point to any word or sentence and hear it read to them. Computer speech feedback is a successful strategy for presenting reading practice to early readers (Davidson et al 1991, in Sands and Bucholz, 1997). Touch screens are particularly helpful to younger children (Dobbins and Bickel, 1982, in Sands and Bucholz, 1997). Miles and Clifford (1993) showed young children with specific reading difficulties making significant progress with this form of computer feedback. Older children also seem to benefit from this approach. In one investigation 14 adolescents spent an average of ten hours working on their reading with the help of a computer. Eight of these pupils subsequently registered average gains of 13 months on a standardised reading test (Clifford, 1999). In each of these examples, the structure of the teaching process was determined by the teacher. Computers were used as part of the teaching environment but did not impose content. Teachers were able to choose from a wide range of hardware: simplified, colour coded and concept keyboards with touch screens, infra-red screens, adapted mice and control buttons. They could arrange devices to read to a group of children or to read aloud to selected individuals. In addition, the dialect of each computer could be adjusted to be more readily understandable by learners.

This way of using talking computers seems to extend the pedagogy for children with learning disabilities but its use in classrooms is as a tool for students with special educational needs. It is rarely employed class-wide, despite data which suggest that it could be appropriately used in such a context. The same limited application of technology applies to voice recognition software (VRS). This software allows users to input ideas into a computer by speaking into a microphone, almost dispensing with the keyboard altogether. Programs which record speech and display it in written form on a screen are now readily available and increasingly affordable. This is particularly useful feedback for a child with persistent specific reading difficulties (Miles and Clifford, 1994). The appearance of a word on screen as it is spoken focuses users' attention on the sounds they are making and the nature of the text which appears. It has been argued that this gives VRS a multi-sensory dynamic (Higgins and Raskind, 2000) which is helpful to all readers but particularly those experiencing difficulties.

In England, the use of VRS in schools is currently largely confined to children experiencing difficulties in learning. It is treated as an individualised technology evaluated in terms of particular groups of disabled learners. For these groups it can be seen as extending their experience of learning. The ability to speak words and data into a machine and have the machine read this input back supports learners in focusing on the relationship between text and sound, and gives them greater control over this reflective process. This feature led researchers, a decade ago, to argue that inclusive class-wide use of voice recognition software is inevitable, as the software set-up process becomes increasingly child-friendly (Miles, Martin and Owen, 1998).

Outcome Three: Transformation

McCormick and Scrimshaw (2001) describe how technology defines some subject areas and how a change of technology can therefore have a profound impact on the subject. Literacy, for example, can be seen as text read and text written, with critical reflection. However, multimedia provides other routes of communication:

> Music, speech, aural ambience, text, video, animation, graphics and symbols, a second language or more, synchronous or asynchronous time and more. It allows us this portfolio of communication possibilities individually, collaboratively, in private, in public, in the same place or in different locations
>
> (Heppell, 1998, pp. 8–9, cited in McCormick and Scrimshaw, 2001)

The technology therefore challenges the accepted definition of literacy.

> A text-based curriculum built around individual endeavour would arguably produce dysfunctional learners in a technological world, which is a highly controversial conclusion to emerge from the promise of multimedia technology. (Heppell, 1998, pp. 8–9, cited in McCormick and Scrimshaw, 2001)

Technology can produce situations in which learners and teachers work together in new ways and may create opportunities for the accommodation of a diverse range of learners. In relation to inclusive education, technology can have an impact on curricula at social and cultural levels and this impact is significantly influenced by the ways in which it is conceptualised and applied. New technologies have the potential to remove or transcend barriers to learning, but also have the potential to recreate or strengthen existing barriers to inclusion.

Case Study 3: Tablet PCs

A relatively recent development in the design of computers in the classroom has been the advent of Tablet PCs. These have been regarded as offering particular affordances for children with learning difficulties. Tablet PCs are lightweight computers with which pupils interact using a digitiser pen which allows them to navigate by touching the screen. The machines have in-built wireless access and speech recognition software, and currently run Windows XP Tablet Edition. Inbuilt handwriting recognition allows students to write journal-based notes in their normal handwriting and then save and search these notes or convert them into a text font. Sheehy et al (2005) looked at how these computers were being used in each education authority in England as a precursor to selected case studies (Twining et al, 2005). Tablet PCs were found to be used in a variety of ways which included support for the work of children with special educational needs.

The intuitive design and action of using a pen directly on the screen was seen as a benefit for both younger children and those with learning difficulties, the interaction with software being more direct through the use of a digitiser pen or stylus. As with the VRS and talking computer examples, Tablet PCs can support curriculum access for students who have difficulties controlling a standard mouse, or who have poor keyboard skills. (Indeed, Tablet PCs can run VRS and talking computer applications). A Tablet PCs with appropriate software can also provide visual or audio feedback as a child moves around the screen, helping them to work with maps or other diagrams. Researchers have also explored the effects of transmitting haptic feedback through the stylus, using an embedded vibro-tactile actuator and non-visual tactile and auditory feedback cues, (Sharmin, Evreinov and Raisam, 2005).

The ease of mobility of Tablet PCs means they are perceived to be mobile tools which can be used wherever pupils need them: on field trips, at home, within hospitals or in special units. By straightforward modification of text size, colour, contrast and audio resources, they can be used effectively to support students with vision and hearing impairments. Some schools use audio notes to annotate and comment on pupils' work, making these comments more accessible not only to the students but also to their parents. When they are used as a tool for the whole class Tablet PCs escape the stigmatisation which is sometimes associated with specialised input devices or adapted keyboards. They are not always used in this way. For example in one school, Tablet PCs were used to support a group of 16 year olds with literacy problems. As only students with these difficulties were provided with this resource, the Tablet PCs became perceived as stigmatising and their use declined. In this case, financial barriers led to Tablet PCs being used as special education tools rather than as inclusive devices for the whole class. The voice recognition and talking aspects of Tablet PCS appeared to be underutilised but teachers still felt that Tablets were more flexible in their uses than standard laptops.

All ideas, including handwritten notes and diagrams, can be saved on a Tablet PC. Pupils can keep these for review and can subsequently search their handwritten notes and annotate or share them. When pupils are missing school their friends can take notes for them and this feature is rated highly by children (Berque et al, 2000). The instant conversion of handwritten notes and diagrams into Word potentially increases time spent studying the material by limiting time spent rewriting or typing notes.

Using electronic books and in-built wireless access removes the need to carry large numbers of books, which has been a barrier for some children with physical impairments. Students appear to be more motivated to use Tablet PCs than standard PCs or paper and pens and this factor was seen as significant for children developing handwriting skills through Tablet-based programmes. There are reports of handwriting recognition being particularly successful when children have poor or impaired motor skills or when they have specific language and writing difficulties (Sheehy et al, 2005). Tablet PCs may also be used to develop collaboration and group work in classrooms, for example, through a networked sharing of information.

In joint problem-solving tasks the pen input has been used effectively for brainstorming ideas. Because pupils can store their work electronically, a wide range of work can be

> accessed and shared, avoiding the difficulties of sharing hard copies. Notes can be emailed to fellow pupils, and pupils are potentially less reliant on teachers as an information source or for distributing copies of relevant materials. As with laptops and PCs, work from class sessions can be saved to a shared network area and accessed when needed.
>
> Sheehy et al 2005, p4.

This suggests several ways in which Tablet PCs can support inclusive educational practices. They can be used to increase the number of students who can access software using the same hardware as their peers, and can also support collaborative learning across a diverse group of learners. They allow students to contribute via a range of modalities: type, handwriting, speech recognition or drawing (constructing and sharing diagrams and mind maps without losing their original format). This may be particularly important for children in secondary schools where physical movement in the classroom is restricted. Tablets encourage a genuine sharing of ideas.

What emerged from our research in English schools was that the Tablet PC is a highly versatile piece of equipment which is used in a wide range of settings, for a wide range of purposes and which supports the learning of a diverse range of children (Sheehy, et al, 2005; Twining et al 2005). Much of what was being achieved with the Tablet PCs could, with some thought, also have been achieved with other hardware such as laptops or personal digital assistants (PDAs). Problems with Tablet PCs related primarily to technical support issues within schools. Teachers who enjoyed using Tablet PCs typically reported having technical support, time to ‘play’ with the machine and opportunities to try out new ways of doing things in order to gain confidence and skills.

Tablet PCs were sometimes used to make the pedagogy more efficient, for example in terms of carrying books and accessing and annotating texts or class materials. Examples of extending pedagogic practices were also found, for example, in making and annotating video recordings of PE lessons in order to improve personal performance. There were also instances of transformation of the pedagogy, with positive benefits for inclusion. The use of Tablet PCs and a wireless network to share ideas and to develop work collaboratively with a range of people across a school allowed a diverse range of children to engage with a curriculum area using their preferred methods of representation. Tablet PCs can support both potentially transformative pedagogies and inclusive education, when learners make use of its wireless and mobile capabilities to work together in new ways

Case Study 4: Robots

In case studies 1 to 3, technology has been used to support traditional curriculum areas and, while pedagogy may develop and become more inclusive, the subject area remains relatively unaffected. This case study focuses on an area that is not part of the everyday school curriculum in the UK – robotics.

The Open University’s Robotics Outreach Group was invited to run a robotics teaching programme at a school which catered for teenage boys who had been excluded from other schools. Many of the pupils carried single and multiple labels of learning disabilities including emotional and behavioural difficulties (EBD), attention-deficit / hyperactivity disorder (ADHD) and dyslexia. Some were involved in legal proceedings and the court system (Sheehy and Johnston-Wilder, 2005). The project team was not sure how a group which was so diverse and potentially difficult to teach would react to the planned six-week programme. The project used the well-known Lego Mindstorms kits (http://mindstorms.lego.com/), which are available from toyshops. Each kit includes Lego construction pieces, gears, motors, sensors and a brick which can be programmed to enable a robot to perform different operations.

The first session contained only seven learners, who were initially disinterested and off task. However, as the lesson progressed from demonstrations to hands-on tasks, swearing and other inappropriate behaviour declined and on-task behaviour increased. The atmosphere within the classroom became productive and positive. All the pupils remained in class throughout the lesson and then voted to extend it. The school was flexible enough to allow sessions to be extended or shortened as appropriate. The teacher commented that this was ‘the most concentration I’ve seen’, and pupils’ comments were similarly positive.

> ‘This is a great lesson.’
> ‘Sir, can we have another lesson of this?’
> ‘Is this science or something, and we can do just this for six weeks?’
> (Pupils’ comments: Sheehy and Johnston-Wilder, 2005)

Whilst this high level of enthusiasm waned a little in subsequent weeks, the pupils completed, and learned from, the programme. There were several points which were noted as supporting the diverse, albeit small, group of disaffected learners and which helped them to remain motivated in their robotics work.

The build activities using the Mindstorms kits could be differentiated in many ways. Some pupils were given partially built objects to complete, which helped them to achieve a successful build relatively quickly. The amount and degree of independent work they needed to do could be tailored by the tutor for each pupil. The role of the tutor was essential in noting the pupils’ interests and helping them to achieve success. Pupils learned most about theories of gearing, motor use and design when these were built into what they wanted to do, after they had been inspired by an initial demonstration. The diagrams which act as plans for different robot models were accessed easily by all the pupils and the on-screen programming icons did not limit pupils with literacy and information sequencing problems. Even so, pupils required considerable support to answer questions, reduce frustration and make the activities successful.

The pupils did not consider the lessons to be about mathematics and science, although this was a large part of what they did, and this was attributed to the fact that these elements were embedded in purposeful real-life activities, building robots which could perform particular tasks. Pupils learned through feedback from the tutors and also from the performance of their own robots and programs. The findings of this small project have much in common with those of Goldman, Eughi and Sklar (2004) which highlighted the ability of technology to engage disaffected learners in situations where a high pupil : teacher ratio exists. Building the robots was a significant achievement for some of our learners and to dismantle them was potentially upsetting. The finished and working model was what they valued rather than the work in progress or acknowledgement of the programming and design skills they had gained.

Educational robotics has some affordances which could make it very supportive of inclusive education. The way in which Lego Mindstorms robots are built using diagrammatic plans and programming icons allows teachers to remove many barriers which children with learning difficulties might experience. Educational robotics in this context also demonstrates some transformational properties. The robotics curriculum is a synthesis of many subject areas which are taught, within this synthesis, in new ways. This has been seen as giving educational robotics a special educational benefit. There is growing evidence, from robotics groups around the country, that robotics can accommodate a diverse range of learners and has many advantages for children with special educational needs (Johnston-Wilder, 2006). .

Although, in the United Kingdom, robotic activities in school settings are usually out-of-hours extension activities for high-achieving pupils, or are offered within segregated provision, educational robotics seems to be an example of a transformative technology. Our research suggests that it can transform the ways in which curriculum subjects are taught and engage children who have experienced failure in traditional subjects. Educational robotics which begins from a practical 'let's build something' approach is capable of significant differentiation which supports a wide variety of learners. Furthermore, it gives the learners an understanding of a real-life technology, which will have an increasing impact on their future lives.

Case Study 5: Virtual Worlds

Robotics illustrates the motivational and transformational potential of technology. Learners who grow up with such technologies will have new expectations about what constitutes an engaging and useful educational experience. Seymour Papert envisaged a future in which 'knowledge machines' would offer children a richer way of finding out about the world, a way based on their own experiences and interests and presented through virtual reality.

> A child who has grown up with the freedom to explore provided by such machines will not sit quietly through the standard curriculum dished out in most schools today. Already, children are made increasingly restive by the contrast between the slowness of School and the more exciting pace they experience in videogames and television. But the restiveness is only a pale precursor to what will come when they can freely enter virtual realities of animals in Africa or wars in ancient Greece… reading will no longer be the unique primary access road to knowledge and learning, and it should therefore no longer be the dominant consideration in the design of School. (Papert, 1993)

The terms 'virtual reality' and 'virtual worlds' typically refer to immersive, computer-generated environments that give the illusion of being situated in three-dimensional space. Virtual worlds combine a desktop virtual environment with synchronous chat communication via typed text or speech. They share three distinctive features (Dickey, 2007):

- the illusion of three-dimensional space
- avatars which serve as the visual representation of users
- Interactive chat which allows users to communicate with each another synchronously.

There are several features that make these environments particularly relevant for people with learning disabilities (Standen, Brown and Cromby, 2001).

People are often denied real-world experiences because their carers are scared of potential consequences. In virtual reality it is possible to learn by making mistakes without suffering dangerous consequences. Access to real-world environments may be limited or hard to arrange. A virtual location can remove access problems (Cooke, Laczny, Brown and Francik, 2002).

The key features needed to understand an environment can be highlighted, making activities more accessible.

Rules and abstract concepts can be made comprehensible through additional language and symbol support.

Skills developed in virtual reality, such as the ability to navigate around a particular place, have been found to transfer to and improve real-world abilities (Rose, Brook and Attree, 2001). Virtual worlds can mediate and influence children's use of language, provide an opportunity for them to try out alternative social interactions and reflect upon their feelings and thoughts.

In the last decade many popular virtual world applications have been developed. These include Active Worlds, blaxxun interactive, OnLive! Traveler and Adobe Atmosphere as well as massively multiplayer online games (MMOGs) such as EverQuest and World of Warcraft (for a review of these environments see Dickey, 2000). Educators have begun to explore and use these virtual worlds as part of their approach to teaching. One team of educational researchers, Schome, was formed with the aim of creating 'a new form of educational system designed to overcome the problems associated with current education systems in order to meet the needs of society and individuals in the 21st century' (http://www.schome.ac.uk/). The group uses virtual worlds as spaces in which

> Visions of future practices and pedagogies can be built and experienced. Such experiences are not easily achieved in the physical world and the group therefore saw virtual environments as important arenas for its work (Sheehy, Ferguson and Clough, 2007)

The team's work has been underpinned by the exploration and development of the inclusivity of these virtual spaces.

Schome Park is an educational virtual island for young people between 13 and 17 years of age. It is owned and run by Schome within the teen area of Second Life (www.secondlife.com), a popular virtual world. An initial research project on the island brought approximately 150 young people on to the island where they engaged in a variety of activities. Group members were geographically dispersed across England but met on Schome Park each day. The group contained a large sub-section of young people from a scholarship programme, which aims to support students from socially disadvantaged backgrounds. The research team considered the impact of in-world skills on real-life skills, especially on the knowledge-age skills of teamwork, communication, leadership and creativity, which are essentially metacognitive skills relevant to communication and work.

The project also stimulated students to develop and implement their own ideas for activities and projects. Schome Park was supported by a wiki and a moderated online forum in which the young people could set up their own forum strands. Discussion ranged from social interaction to issues such as whether weapons should be allowed on the island and what form of in-world government should be introduced. However, communication through avatars was rated more highly than that using the traditional forum threads. Use of avatars as a means of communication was seen as enjoyable and it had certain advantages over forum conversations.

'You always get a feeling that you can apply the skills and experience here to RL [real life]. just talking to new people too, it builds up confidence.'

'I learn about rl things here too… you can chat in simulated environments which is much easier then forums i believe'

'The avatars kind of give you a face… what i mean is avatars kind of give you a sense of you actually speaking to a real person.. the avatars are just projections of a person.' Schome Park interview chat log

One thing that I'm really grateful to Schome Park for doing is making me feel more confident about trying new things, and also about helping others if I know something they don't, through communication. Learning certainly doesn't have to be a pen and paper – I much prefer learning through the Schome way, because it has much more bearing on RL than a load of stuff I will have forgotten in a year's time.

Schome Park Forum Comments

The research team found that the virtual island did present affordances which could support the development of knowledge-age skills, indicating the potential of Schome Park, and the connected Schome resources, as an educational environment. In many respects the virtual world technology of Schome Park was transformational. Students learned about Roman Britain by building and exploring fortifications, creating Roman garments for their avatars and role playing situations. The Schome Park physics group built trebuchets and analysed the mathematics of projectiles. These activities were carried out by teenagers from different parts of the country who were of different ages and backgrounds and had never met in real life. In terms of access and navigation, the Schome virtual environments have been used successfully by young people with a range of impairments. A small recent study found that young people with severe learning difficulties (intellectual impairment) could navigate and explore the island. Their interactions through text chat was often not standard but still worked and they stated that they preferred in-world text chat to using in-world voice communication.

However, analysis of who was using Schome Park and its resources revealed that members of the socially disadvantaged group were least likely to use these facilities. Although this group had access to computers at school, it was the relatively affluent youngsters with high-spec computers and broadband access at home who were the main users. These economic barriers to learning were separate from the in-world design of Schome Park and their presence highlighted the possibility of creating a digital divide in situations which advantage learners from relatively affluent backgrounds. Being digitally connected is an increasingly critical aspect of our educational and social experience. Technological competence is a new education essential, equal access and equal competence must be basic concerns for educators (Kenway, 2001). Access to and participation in such learning experiences must now form part of inclusive approaches to education. Access to the internet has been argues as being a basic right (Pavely 2002).

There is evidence that information poverty will follow existing patterns of economic inequality in society and those unable to use and access new technologies will be excluded from key economic and social activities (Webster, 1995; Facer and Furlong 2001). In line with this view, disabled people have reported that the greatest barriers to their internet access are financial (Seale, 2001). There is a large overlap between social and educational inclusion. Further debate will decide whether virtual experiences in which disabled students remain physically separate from their peers are examples of a move towards inclusion or simply novel experiences that allow segregation to continue. It has already been argued that such experiences are simply ‘layering new inequalities over old’ (Kenway, 2001 p151).

Comparing Technologies in Inclusive Education

We have presented several new technologies and considered the extent to which they influence pedagogy and inclusion, using three levels of outcome (Twining, 2004). A more detailed investigation of the pedagogical aspect of these examples involves examining how the technology might support, or fail to support, specific features of effective inclusive educational practice. An international systematic literature review considered the outcomes of empirical research which could give insights into the nature of effective educational practices in inclusive classrooms (Sheehy and Rix, 2007). This review identified five key features of successful learning in inclusive classrooms:

- **Prioritising social engagement.** Social interaction is treated as an important means of knowledge development.
- **Presenting materials flexibly in a range of modalities.** Learning activities are presented in different ways (visual, auditory and kinaesthetic) to make subject knowledge accessible to a diverse range of learners.
- **Scaffolding student learning.** Learners’ understanding is developed through planned scaffolding of the subject’s cognitive and social content.
- **Providing authentic activities.** Teachers use activities which learners find meaningful and which educators consider appropriate to the curriculum area.
- **Participating in a pedagogic community.** Teachers form links with others who have a shared view of how their students learn about particular curriculum area. This gives them a clearer understanding of how to teach a curriculum subject and an understanding of why they are doing so.

The examples of morphing software and talking computers appear to be relatively weak with reference to these features. They are currently constructed as tools for meeting special needs and deficits. They focus on what the learner lacks and use technology as a prosthetic to deal with this deficit. An alternative approach can be seen in the movement towards Universal Design. This approach begins from a different starting point to the deficit model, namely that products and environments are designed at the outset to be used by people of all ages and abilities, to the greatest extent possible, without adaptation. (Universal Design Institute, 2003)

A simple example of the differences between the two approaches is the design of accessible buildings. A universal design approach would support a diverse range of people: young children too small to manage large steps, older people with mobility problems, those pushing prams or carrying heavy items. In contrast, a deficit approach would carry out an assessment of the deficits of a group of people and arrange individualised support for those who could not access the building. The first approach views the building's design as the problem; the second views individual people as the problem. The deficit approach has its uses and clearly an individual's impairments must be addressed, however it is the rationale of the two approaches which is important in terms of inclusion.

Tablet PCs are being used in ways which support or enable more features of effective inclusive education. They have been used to support student learning through social interaction and they allow materials to be presented in different modalities. Research has also identified examples of the authentic nature of work being supported through Tablet PC use, for example by animating drawings or annotating videos in art and physical education lessons (Sheehy et al, 2005). However, Tablet PCs are used to support a deficit approach when they are given to a single child, or disabled group. In these settings their function is primarily one of curriculum access.

Educational robotics and virtual worlds both offer excellent opportunities for scaffolding learners' activities. Both also provide highly authentic activities which are relevant to a variety of subject areas. In terms of flexibility of modality of activities and materials, robotics can be seen as offering a wider range of possibilities as both real-world and computer-based activities are possible. Both areas offer teachers the opportunity to join active pedagogical communities to which they can contribute. It is interesting that the potentially most inclusive technologies are being used by teachers and children largely outside the formal education system, whereas the other technologies fit more easily into traditional classrooms.

CONCLUSION

To be included in society will increasingly involve access to, and participation in, the practices and benefits derived from technology. In this chapter we have looked at some new technologies in terms of inclusive education and perhaps future developments may create technologies in order to proactively support educational inclusion. This may require a paradigm shift is in our models of the curriculum and how children learn (Phelan, 2001) and also a universal design approach to both classroom practices and the pedagogies within them. New technologies may provide teachers with affordances that have the potential to support diverse groups of learners, but this potential can fail to be realised within the classroom. The examples of educational robotics and virtual worlds illustrate the potential of new technologies to support this transformation in pedagogy yet these developments are largely occurring outside of the mainstream classroom rather than within it. We cannot reliably predict where the interaction of technology and inclusive ideals will lead us. The future will reveal the extent to which these engaging and inclusive educational technologies transfer to and change the nature of mainstream education.

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